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FEDERATED MALAY STATES.



MEDICAL REPORT FOR THE YEAR 1919.

VITAL STATISTICS.

The estimated population for the Federated Malay States for each of the past nine years is shown thus :

1911	...	...	...	...	...	...	...	...	1,045,947
1912	...	...	...	...	...	...	...	...	1,081,799
1913	...	...	...	...	...	...	...	...	1,117,625
1914	...	...	...	...	...	...	...	...	1,136,500
1915	...	...	...	...	...	...	...	...	1,172,336
1916	...	...	...	...	...	...	...	...	1,208,177
1917	...	...	...	...	...	...	...	...	1,244,018
1918	...	...	...	...	...	...	...	...	1,279,859
1919	...	...	...	...	...	...	...	...	1,315,700

BIRTHS.

Thirty-two thousand three hundred and twenty-five births were registered during the year giving a birth-rate of 24.57 per mille population. The births and birth-rates for the past nine years are as set out below :

Year.		Births.	Birth-rate per mille.
1911	...	20,310	19.41
1912	...	25,426	23.50
1913	...	26,349	23.05
1914	...	27,978	24.61
1915	...	29,699	25.33
1916	...	29,337	24.20
1917	...	34,763	27.94
1918	...	33,011	25.70
1919	...	32,325	24.57

DEATHS.

The deaths during the year numbered 38,645 giving a death-rate of 29.37 per mille. With the exception of 1915 it is the lowest rate recorded for any year since 1911.

The deaths and death-rates for the past nine years are as shown below :

Year.		Deaths.	Death-rate.
1911	...	40,914	39.11
1912	...	40,901	37.08
1913	...	38,000	34.00
1914	...	39,003	34.31
1915	...	33,899	28.92
1916	...	36,981	30.06
1917	...	42,514	34.17
1918	...	67,639	52.85
1919	...	38,645	29.37



PRINCIPAL CAUSES OF DEATHS.

The diseases which caused the greatest number of deaths were malaria, dysentery and diarrhoea and pulmonary tuberculosis.

Table showing causes of deaths in 1919:

		No. of deaths.	Death-rate per mille.
Malaria	...	16,975	12.90
Dysentery and diarrhoea	...	3,712	2.82
Pulmonary tuberculosis	...	2,445	1.86
Pneumonia	...	2,016	1.53
Beri-beri	...	939	.71
Ankylostomiasis	...	599	.45
Cholera	...	237	
Brights disease	...	123	
Malignant diseases	...	109	
Syphilis	...	101	
Influenza	...	73	
Black-water fever	...	34	
Tetanus	...	24	
Enteric	...	22	
Diphtheria	...	6	
Small-pox	...	1	
Plague	...	1	
Convulsions	...	3,096	
Other diseases	...	8,132	
Total	...	38,645	

The following table shows the death-rates from malaria for the past nine years:

Year.	Deaths.	Rate.
1911	17,440	17.47
1912	17,870	16.52
1913	16,414	14.69
1914	13,634	11.99
1915	15,208	12.97
1916	17,627	14.58
1917	18,750	15.07
1918	31,515	24.62 Influenza epidemic year.
1919	16,975	12.90

Malaria death-rate shows a slight reduction; if we had only enough staff of doctors and engineers to deal with this, the most serious drawback in Malaya, the mortality would have been still less—every effort must be made to get the men required. The work which has been done has proved most beneficial; this is shown in the report of the Malaria Advisory Board. The investigations carried out at the Malaria Bureau have been very instructive and will do much to ensure that future work is carried out on sound lines—a separate report from the Bureau has been printed and others will follow at intervals.

Influenza of a mild type has prevailed, fortunately, it has never become epidemic.

Arsenobenzol has proved a great success in the treatment of yaws, large numbers of Malays have been cured after one injection—many of these people had been crippled for years with ulcerated feet.

The treatment of hookworm infection has been vigorously carried out and the value of chenopodium oil, strongly recommended by the Rockefeller Commission who investigated thousands of cases, has been manifest.

Phthisis and pneumonia need careful watching—there is little doubt that this country receives a fairly large number of Chinese infected with phthisis and both ailments are largely influenced by the way people are housed. (As a result of inquiry in both Panama and South Africa the conclusion arrived at, is, that pneumonia prevails when many people live under one roof.) In this country an effort has been made to improve dwellings and all buildings in Sanitary Board (Municipal) areas have to be of a certain standard—in most respects this is right but it is a question whether such a system is not encouraging pulmonary disease—the dwellings are expensive, owners must get a fair return for expenditure so a larger number of people occupy them than is satisfactory—it is probable that in some respects the attap dwellings of the Malay are more suitable to Asiatics in this country than modern types—it may be argued that town inhabitants should be encouraged to live in suburbs but the Oriental insists on living on his business premises and it would be difficult to make him change his habits—as far as we know at present the only solutions are to make a large number of people live outside towns and insist on few occupants of individual dwellings. The total number of deaths from both phthisis and pneumonia are not very large and not increasing rapidly but these diseases cannot be ignored.

The following table shows the death-rates from pulmonary tuberculosis for the past eight years:

Year.							Deaths.	Rate.
1912	...	...	...	...	...	...	1,353	...
1913	...	...	...	...	...	...	1,623	...
1914	...	...	...	...	...	...	1,655	...
1915	...	...	...	...	...	...	1,995	...
1916	...	...	...	...	...	...	2,193	...
1917	...	...	...	...	...	...	2,446	...
1918	...	...	...	...	...	...	3,184	...
1919	...	...	...	...	...	...	2,445	...

The infantile mortality rate was 188.39 per thousand births as against 234.07 in 1918.

INFECTIOUS AND CONTAGIOUS DISEASES.

The year 1919 was remarkable for the few cases small-pox, plague and cholera ; of the 237 deaths recorded for cholera, 233 of this number occurred at the Quarantine Camp, Port Swettenham, among newly arrived Indian immigrant coolies.

Pamphlets with instructions regarding venereal diseases have been issued and as much as possible been done to inform people of the seriousness of these ailments and the necessity of prompt skilled treatment.

MEDICAL INSTITUTIONS.

	Hospitals.	Gaol hospitals.	Lunatic asylum.	Leper asylum.	Out-door dispensaries
Perak ...	21	3	1	2	4
Selangor ...	14	1	1	1	4
Negri Sembilan ...	7	1	—	—	2
Pahang ...	6	2	—	—	7
Total ...	48	7	2	3	17

IN-DOOR PATIENTS.

		No.	Deaths.	Percentage of deaths.
Perak	...	44,925	4,204	9.36
Selangor	...	33,684	2,997	8.89
Negri Sembilan	...	14,380	1,424	9.9
Pahang	...	6,840	473	6.91
Total	...	99,829	9,098	

OUT-PATIENTS.

The number of out-patients treated in the various hospitals was 241,682 compared with 254,891 in 1918.

MALAY HOSPITALS.

The number of Malays treated were:

LEPER ASYLUMS.

Eight hundred and forty-three lepers were under treatment during the year in the three asylums:

QUARANTINE CAMP, PORT SWETTENHAM.

Fifty-two thousand two hundred and fifty immigrant coolies passed through the camp as compared with 32,696 last year. The daily average number in camp was 1,433.8. Six thousand seven hundred and twenty-seven cases were treated in the Camp Hospital against 1,214 last year.

VACCINATION.							
						1918.	1919.
Perak	...	...	...	...	...	47,006	...
Selangor	...	...	...	...	...	42,224	...
Negri Sembilan	...	...	...	...	...	13,478	...
Pahang	...	...	...	...	...	3,053	...
					Total	105,761	136,515

ESTATE STATISTICS.

Returns were received from 1,098 estates distributed as follows :

Perak	...	...	...	...	...	...	...	506
Selangor	...	...	...	...	...	...	...	332
Negri Sembilan	...	...	...	...	...	...	...	230
Pahang	...	...	...	...	...	...	...	30

The total number of labourers was 223,720, of whom 145,836 were Indians.

The table below sets out the mortality rates among estate labourers during the past nine years, that is since the Health Branch took over the supervision of health conditions on estates :

Year.		Labourers employed all nationalities.	Deaths.	Death-rate per mille.
1911	...	143,614	9,040	62.9
1912	...	171,968	7,054	41.02
1913	...	182,937	5,592	29.6
1914	...	176,226	4,635	26.3
1915	...	169,100	2,839	16.78
1916	...	187,030	3,299	17.61
1917	...	214,972	3,906	18.71
1918	...	213,423	9,081	42.55
1919	...	216,573	3,384	15.16

There were 2,764 deaths among the 145,836 Indian estate labourers giving a mortality of 18.95 per mille.

Malaria was the principal cause of illness and mortality. This disease accounts for 42.43 per cent. of the admissions to estate hospitals and for 28.34 of the deaths.

CHIEF TOWNS.

The subjoined table sets out the estimated population and death-rate per mille of the principal townships during the past seven years :

Year.	Kuala Lumpur.		Taiping.		Ipoh.		Seremban.	
	Population.	Death-rate.	Population.	Death-rate.	Population.	Death-rate.	Population.	Death-rate.
1913	...	56,487	35.62	20,992	45.01	26,560	34.07	10,227
1914	...	58,107	33.88	21,615	46.63	27,675	30.08	10,617
1915	...	59,727	27.83	22,237	33.99	28,796	27.08	11,007
1916	...	61,443	27.73	22,859	36.00	29,913	30.15	11,397
1917	...	63,064	28.45	23,481	31.00	31,032	32.67	13,620
1918	...	64,686	38.34	24,108	41.61	32,150	35.92	14,082
1919	...	66,308	26.36	24,721	37.45	33,238	23.56	14,544

WOMEN'S HOSPITALS.

KUALA KANGSAR.

The Lady Medical Officer, Kuala Kangsar, reports that the total number of cases treated during the year were :

Out-patients	...	...	...	...	...	...	...	3,501
Surgical and gynecological	...	...	...	...	...	...	...	68
Patients in own houses	...	...	...	...	...	...	...	308
Patients in hospitals	...	...	...	...	...	...	...	909
Travelling dispensary	...	...	...	...	...	...	...	809
							Total	5,595

as compared with 4,850 for previous year.

KUALA PILAH.

The number of both in and out-patients show a satisfactory increase deducting cases due to influenza in 1918 there were 86 more in-patients and 667 more out-patients. The number of patients visited in kampongs decreased by 238 however. This decrease was due to the fact that there was so much work to do in the hospital that Miss C. B. Kibble had no time to make rounds in the district and only went to outlying places when sent for either to see light cases or because there was particularly large amount of sickness.

METEOROLOGY.

Taiping.—The highest temperature was 95° in June and the mean temperature was 81°—lowest 68°. The driest month was June when 2.28 inches fell. The heaviest rainfall recorded in any one month was 29.53 inches in April.

Highest rainfall, Selama	...	...	...	...	...	4,232 mm.
Lowest	„	Sitiawan	...	...	...	1,789 mm.

SELANGOR.

Highest temperature: Rawang, 105°; lowest, Klang, 90°.

Rainfall: highest, Serendah, 2,902 m.m.; lowest, Sabak Bernam, 1,741 mm.

NEGRI SEMBILAN.

Highest temperature: Kuala Pilah, 99°; lowest, Jelebu, 64°.

Rainfall: highest, Port Dickson, 2,437 mm.; lowest, Jelebu, 1,416 mm.

PAHANG.

Highest temperature: Kuala Lipis, 96°; lowest, Kuantan, 64°.

Rainfall: highest, Pekan, 3,700 mm.; lowest, Bentong, 2,050 mm.

CENTRAL LUNATIC ASYLUM.

The Medical Superintendent, Central Lunatic Asylum, in submitting the ninth annual report, states as follows :

		Males.	Females.	Total.
There remained on 31st December, 1918	...	610	175	785
Admitted during 1919	...	347	68	415
Discharged	...	131	25	156
	(a) Recovered	17	12	29
	(b) Relieved...	—	1	1
	(c) Not improved	—	—	3
	(d) Not insane	3	—	3
Absconded	...	36	2	38
Died	...	166	30	196
Remaining on 31st December, 1919	...	604	173	777
				777

In addition there were *Singapore Patients*—

Remaining on 31st December, 1918	...	143	47	190
Admitted during 1919	...	35	—	35
Discharged	...	4	1	5
Died	...	45	7	52
Remaining on 31st December, 1919	...	129	39	168
				168

Johore Patients—

Remained on 31st December, 1918	...	22	—	22
Admitted during 1919	...	10	4	14
Discharged	...	2	—	2
Absconded	...	1	—	1
Died	...	9	—	9
Remaining on 31st December, 1919	...	20	4	24
Criminals remaining on 31st December, 1918	...	44	1	45
Admitted during 1919	...	25	2	27
Discharged	...	9	—	9
Absconded	...	1	—	1
Died	...	10	—	10
Remaining on 31st December, 1919	...	48	3	51
				51
Total remaining on 31st December, 1919	...			1,020

The total population has decreased from 1,042 to 1,020 accounted for by a decreased admission and an increased recovery rate.

As regards the forms of insanity on admission recent melancholia heads the list again with 103 cases. Recent mania has gone from fourth place to second with 73 against 58, while confusional insanity and primary dementia have each gone down a place to third and fourth, respectively. The reduced number of cases of primary dementia is satisfactory, for, though a first attack is frequently recovered from, the chance of another break-down later on in life is very probable.

There were 22 cases of G.P.I. (20 males and two females) against 26 in 1918.

Recovery rate is 37.41 per cent. as against 33.27 per cent. last year.

Four causes head the list syphilis-gastric, intestinal disorders, alcohol, malaria. Heredity is always stoutly denied.

Death-rate 17.42 to total treated and 19.29 on daily average number of patients.

Criminal admissions were 27 against 9 in the previous year.

Farm supplied produce to the value of \$10,384.59 and tobacco is now being grown for the first time.

VETERINARY BRANCH.

RINDERPEST.

Selangor.—Two outbreaks of this disease occurred at Port Swettenham Quarantine Station amongst cattle imported from Siam via Singapore during August, 16 cases breaking with three deaths—33 contact animals were inoculated with anti-rinderpest serum.

Negri Sembilan.—An outbreak was detected at Gedong Lallang, Seremban, during October, the original case occurring in a bullock imported from Malacca during August. Fifty-four cattle became infected and 18 died. One hundred and sixty-one animals were inoculated, of which 21 became infected and three died. Immediately the outbreak was discovered, sick animals and contacts were isolated in the Cattle Quarantine Station, Seremban, and by strictly enforcing the quarantine it was possible to localize the disease to a comparatively small area and the outbreak ceased on 1st December.

SURRA.

Perak.—There were three cases of surra among the ponies in the Krian district, of these two were shot and one died. One case occurred at Tapah, the infected animal being a dog which was destroyed.

Negri Sembilan.—Three cattle died from surra at Jemina Estate, Coast district; the blood of those examined being found to be swarming with trypanosomes.

FOOT-AND-MOUTH DISEASE.

Perak.—Twenty cases occurred at Telok Anson Quarantine Station among the buffaloes imported from the west coast of Siam. Thirteen recovered and seven died.

Selangor.—Two thousand and thirty-six cases of this disease occurred, cases being recorded in all districts from time to time. The disease was of the usual wild type and three deaths occurred.

Negri Sembilan.—This disease occurred from time to time in all districts from January to September and was of the wild type—total cases 1,219 with five deaths.

Pahang.—With the exception of an outbreak of this disease, which occurred in Ulu Pahang in April lasting a little over four months and affecting Kuala Lipis, Raub and Bentong districts, the State was free from the occurrences of an infectious cattle disease.

RABIES.

Two cases of dumb rabies occurred in Kuala Lumpur. The diagnosis was confirmed in both cases by microscopical examination of the brain at the Institute for Medical Research, Federated Malay States. Four cases were reported from Batang Malaka, Tampin district, the diagnosis in two of these being confirmed.

SWINE FEVER.

Sixty-nine cases with 64 deaths occurred during the first two months of the year. These outbreaks were confined to Kuala Lumpur district and during the last 10 months the State has been free from this disease.

Pleuro-Pneumonia of Goats.—This disease occurred at Ampang and Ulu Klang; there were 64 cases and 64 deaths. The outbreak ceased in May. Since when no further cases have been detected.

POLICE CASES.

		Cases.	Convictions.	Fines.
Perak	...	684	646	\$5,467.00
Selangor	...	609	589	4,268.00
Negri Sembilan	...	249	230	2,948.50
Pahang	...	80	77	929.00
Total	...	1,622	1,542	13,612.50

QUARANTINE STATION.

Port Swettenham.—Fourteen thousand seven hundred and one animals passed through this Quarantine Station, of which number 7,765 were quarantined.

Bukit Sutil.—Seven hundred and two cattle were quarantined.

FINANCE.

The total revenue collected during the year was as follows :

Perak	...	...	...	...	...	\$79,462.78
Selangor	...	...	...	...	...	51,842.80
Negri Sembilan	...	...	...	...	...	19,133.82
Pahang	...	...	...	...	...	6,585.98

The total expenditure under Personal Emoluments and Other Charges amounted to \$2,373,958.31.

STAFF.

The staff during the year consisted of :

	Total number of officers authorized for 1919.	Total number of officers actually available for service during 1919.	Number of officers who were absent on military service or leave.	Number of vacancies.	Remarks.
Principal Medical Officer	1	1	...	...
Senior Medical Officer	2	1	1	...	
Medical Officers	32	15	9	8	Dr. Fry transferred to Penang. Drs. Eagles and Morgan resigned during the year
District Surgeon	1	1	...	...
Lady Medical Officer	4	1	...	3	
Medical Entomologist	1	1	...	...
Assistant Medical Officers	5	4	...	1	One being transferred to I. M. R.
Assistant Surgeons	48	35	...	13	
Lady Assistant Surgeon	1	1	...	...
Hospital Assistant, Special Grade	4	4	...	...
Hospital Assts., Grade I	41	41	...	...
" " II	169	168	...	1	
Dressers, Grade III, and Probationers	144	140	...	4	
Matrons	4	2	2	...	
European Sisters	22	14	...	8	
Health Officers	7	4	2	1	

From January to March Dr. A. J. McClosky, Senior Medical Officer, Selangor, acted as Senior Health Officer, Federated Malay States, in addition to his own duties. On 5th March Dr. A. R. Wellington was transferred from the Coast districts of Selangor and took up duty as Senior Health Officer, Federated Malay States.

In April Dr. J. T. Clarke, Health Officer, Kinta, and Dr. R. Cox, Health Officer, Perak North, were granted long leave on medical certificates.

In December Dr. W. P. Meldrum who had broken down in health was pronounced medically unfit and recommended for retirement.

For the greater part of the year the Health Branch was understaffed by 50 per cent. and supervision of estates and towns suffered in consequence.

The following officers were appointed during the year : Dr. E. N. Graham (temporary) as Medical Officer, District Hospital, Kuala Lumpur, and Sisters A. M. Johnson, A. G. Boyd, A. Jennings, E. M. Hall, M. Hawthorn, J. F. P. Haslegrave, L. M. Whellan, E. M. Hardcastle and F. M. Baldie.

Resignations.—Drs. D. C. Macaskill and V. T. W. Eagles, and Sisters S. E. Hansom, L. C. Browning, O. J. Marriott and Haswell resigned during the year.

Retirements.—Dr. F. C. Morgan retired on medical certificate from 9th July, 1919, and Miss H. M. Shaw, Matron, European Hospital, Kuala Lumpur, retired on pension in March and was succeeded by Miss A. M. McBride.

Dr. W. H. Fry was transferred as Chief Medical Officer, Penang, with effect from 15th August, 1919.

I regret to have to record the death of two Assistant Surgeons, Messrs. P. B. Ghosh and A. S. Kanapathipillay—they were able men and much respected by all.

I wish to call attention to the work done by the staff seriously handicapped as the department has been owing to depletion caused by war “invalidism” and no new arrivals, both Medical and Health Officers and Assistant Surgeons have had extra responsibilities yet they have been shouldered without complaint and many men long overdue for leave have refrained from asking for it in order that the medical work in this country should be carried on with as little interference as possible—statistics show that their efforts have not been unsuccessful.

The following reports are printed as appendices:

Report of the Medical Entomologist;

Report of the Institute for Medical Research;

Report of the Executive Engineer, Malaria Advisory Board.

KUALA LUMPUR.

CHARLES LANE SANSOM,

Principal Medical Officer, F.M.S.

MALARIA BUREAU ANNUAL REPORT, 1919.

The year's work shows useful progress but has been hampered by sickness and invaliding.

SUBORDINATE STAFF.

At the beginning of the year the staff consisted of :

Two Laboratory Assistants, Class I;
 Five " " " II;
 Seven Collectors;
 Two Clerks;
 Two Gardeners;
 One Peon.

During the year one laboratory assistant and one clerk resigned, one collector absconded and one laboratory assistant and one collector ceased to be employed. These losses were made up by appointing one laboratory assistant and two collectors.

A new appointment of librarian was made and the holder, Mr. Santa Maria, a late clerk in the Selangor Secretariat, has proved a most valuable assistant, and has taken a great deal of routine office work off my hands and saved valuable time.

SICKNESS.

The year's work has been greatly interfered with by sickness, an inevitable concomitant of the work which can only be provided for by an increase in the number of officers so as to insure against the loss of time and work due to temporary casualties. During the last six months of the year I have been practically an invalid and unable to make proper use of the extended facilities of staff and money. The sum of \$8,800 has had to be returned unexpended and this could have been used to great advantage if I had been in a fit condition to undertake the work.

The subordinate staff has suffered but not to the same extent as myself. The record of my personal illness is as follows :

March 31st to April 6th.—I had an attack of quartan fever which was probably due to the work done at Perhentian Tinggi from the 12th to 26th March. It is interesting to note that the only parasites found in the six Government servants stationed at this place were also quartan, and that an infected specimen of *A. maculatus* was caught there.

May 5th to 10th.—The work in Pahang was brought to a premature close by five out of the party of six succumbing to malaria. The infection was probably a simultaneous one as the whole party was exposed to infection in one place on 20th April, which would give an incubation period for the five cases of 15, 16, 17, 18 and 20 days, respectively. It is unfortunate that no blood records of this outbreak are available as the specimens were spoiled before any examination was possible, but, from the continued remittent type of fever, my attack was probably due to subtertian parasites.

In June, August and December.—I had relapses with benign tertian parasites, the third relapse leading to my being invalidated home on a medical certificate.

EXPENDITURE.

The money passing through the office may be classified as follows :

SALARIES AND WAR ALLOWANCES—

Medical Entomologist	...	...	...	...	...	...	\$ 9,114.97
Staff	...	...	...	...	...	...	10,660.95

TRAVELLING EXPENSES—

Purchase of car	...	...	...	...	...	...	2,550.00
Maintenance of car	...	...	...	...	...	...	1,080.00
Bicycle allowances	...	...	...	...	...	...	790.00
Fares and freight	...	...	...	...	...	...	682.78
Night allowances	...	...	...	...	...	...	915.31

ACCOMMODATION 1,997.07

OTHER EXPENSES—

Laboratory equipment	...	...	...	...	...	...	361.24
Equipment for field work, clothing, etc.	...	...	...	...	...	...	578.68
Library	...	...	...	...	...	...	544.83
Publication of reports	...	...	...	...	...	...	1,502.52
Office equipment	...	...	...	...	...	...	190.84
Postage	...	...	...	...	...	...	4.36
Upkeep of grounds	...	...	...	...	...	...	30.60
Sanitary Board bills, electric light and water	...	...	...	...	...	...	114.00

Total ... \$31,118.15

ACCOMMODATION.

The accommodation has been greatly extended in the following directions :

- (1) The large central room has been fitted up as a laboratory with benches, sinks and water supply ;
- (2) A balance room with a concrete pedestal for a balance has been made ;
- (3) An ant-proof mosquito house for experiments on a large scale has been erected ;
- (4) A boat has been obtained for river and swamp work. A boat-house to accommodate this has been built on the bank of the Klang River near the Bureau ;
- (5) Three cupboards have been added and minor improvements to the laboratory and museum have been made.

All this work has been done through Government departments—namely, the Government Architect's Office and the Factory.

LIBRARY.

Eighty new books and periodicals have been added this year and the foundation of a useful reference library has been laid.

WORK DONE AND SUMMARY OF RESULTS.

FIELD WORK.

The figures relating to field work are as follows :

Breeding places found and examined	...	...	...	...	1,365
Larvæ identified microscopically	...	...	...	...	20,506
Adults bred out and identified	...	...	...	...	4,802
Adults caught in houses	...	...	...	...	733

No new species were found to add to the type collection of 20 species described last year but fresh specimens have been added to the collection and it is in good order. The original methods of record keeping have been followed and a card index to the field notes has been kept up to date, rendering the material readily available for reference. A start has been made in training men outside the staff in field work and the detection of breeding places. It might be useful to expand this part of the work and selected men could be sent by estates, medical practitioners and Government departments to be attached to the staff for a time as supernumeraries, thereby receiving a training which would be useful in anti-malarial work.

ESTIMATION OF MALARIA.

Blood and spleen work has been done in this connection and 880 specimens of blood have passed through the laboratory. Hæmoglobin estimations have also been carried out and important results confirming the marked loss of hæmoglobin in cases with evidence of malaria have been obtained.

VISITORS AND PUBLICITY.

Seventeen visits have been recorded, including one of the Chief Secretary on 7th June. More interest has been taken in the working of the Bureau and many visits have been paid but not recorded. Several applications for information have been received, in some cases data were available and were forwarded. Two of these communications have led to work which is still proceeding.

Two hundred and forty-one specimens have been sent in for identification and reports on these have been sent out. In four cases the specimens have been sandflies and culicines which are outside the present scope of work and only approximate naming was attempted. The scope of the work will shortly be widened to include all blood-sucking insects, the receipt of specimens for identification or of problems for investigation will be welcomed and a close connection between the Bureau and outside workers is to be encouraged for mutual benefit.

PUBLICATION OF REPORTS.

Six of the reports issued since 1917, with certain other data, were chosen as the contents of a first volume and it is hoped to issue further volumes as material becomes available. A copy will be sent to every medical practitioner in the country and copies will be available for any one interested in the subject on application to the Medical Entomologist.

ASSOCIATION TABLES.

This method of associating the species of anophelines into representative faunæ was described in last year's Annual Report. The method has been continued throughout the year and a scheme of recording the association units has been evolved which enables additions to be made readily from time to time as batches of data become available. The total association units up to present are only 5,621 and it will need several years' work before the figures become large enough to be reliable but I think it is a method that should be continued.

Some characteristic examples of the data derived by the method may be of interest and are given below:

A. asiaticus—

Number of association units	...	...	...	18
Number of times found alone	...	...	...	18 times or 100 per cent.
Association with other species	...	...	...	Nil.

This is because it has only been found in bamboos, a very specialized breeding place in which no other species of anopheline has been found as yet:

A. fuliginosus—

Number of association units	...	...	...	...	...	131
Found alone	...	...	...	...	...	7.63 per cent.
Association with <i>A. barbirostris</i>	...	...	...	...	...	25.95 ,
" " <i>A. sinensis</i>	...	...	...	...	...	38.93 ,
" " <i>A. rossi</i> var. <i>indefinitus</i>	...	...	...	...	...	13.74 ,
" " <i>A. aconitus</i>	...	...	...	...	...	7.63 ,
" " <i>A. rossi</i> (Giles)	...	...	...	...	...	3.82 ,
" " <i>A. karwari</i>	...	...	...	...	...	.76 ,
" " <i>A. kochi</i>	...	...	...	...	...	.76 ,
" " <i>A. tessellatus</i>	...	...	...	...	...	.76 ,
					Total	99.98 per cent.

The chief associates of *A. fuliginosus* are seen to be *A. barbirostris* and *A. sinensis*, species breeding typically in large open swamps. It has no association with *A. maculatus*, the typical small pool breeder, and is but seldom (0.76 per cent.) found with *A. kochi* and *A. karwari*, other species which prefer small pools. The association with *A. rossi* var. *indefinitus* (13.7 per cent.) is rather high but although this species prefers small muddy pools it is also found frequently in large swampy areas. As the data increase this per centage will probably drop below that of *A. aconitus* and *A. rossi* (Giles) both open swamp breeders and next in the order of frequency of association.

There is no association with *A. aitkeni*, *A. leucosphyrus* or *A. umbrosus*, typical jungle species.

On these grounds *A. fuliginosus* may be placed with some certainty in the fauna characteristic of large open swampy pools.

The habitat of *A. rossi* (Giles) and *A. rossi* *indefinitus* may also be compared by the method.

A. rossi (Giles) was never found alone and its chief associates are *A. barbirostris* (25.8 per cent.) and *A. sinensis* (22.6 per cent.) which places it in the open swamp fauna. *A. rossi* var *indefinitus*, however, was found most frequently alone (58.61 per cent.) and its highest association is with the small pool breeder *A. kochi* (10.60 per cent.) which places it in the open small pool fauna.

ARTIFICIAL BREEDING PLACES.

During the whole of the field work anophelines were found in disused receptacles only eight times this year. The following table shows the kind of article and the species found:

Nature of receptacle.	Species found.
One black biscuit tin...	<i>A. maculatus</i>
One round tin (six inches wide)	<i>A. maculatus</i> (L)
One kerosene tin	<i>A. maculatus</i>
One broken iron pan	<i>A. maculatus</i>
One rice-cooking pan...	<i>A. kochi</i>
One biscuit tin (used for white-washing)	<i>A. kochi</i>
One broken jar	<i>A. rossi</i>
One spittoon ...	<i>A. rossi</i>

It will be seen that all the species found are ones which prefer small open pools. All the receptacles were very old and thus approximated to natural conditions. Three of these were found at Perhentian Tinggi in a ravine which had been recently filled in, thereby destroying a large number of breeding places; and the question raised in last year's report, as to whether the occasional use by anophelines of artificial places for breeding purposes indicates the possibility of anophelines becoming domesticated when all their natural breeding places are destroyed, is still unsettled. The rarity with which it occurs almost suggests that the use of artificial places for breeding is accidental, but the possibility of it becoming more common cannot be ignored until some light is obtained on the problem.

Anophelines have also been found in concrete water tanks on three occasions. In two of these *A. kochi* and *A. barbirostris* were found and in the third *A. kochi* only.

PECULIAR BREEDING PLACES.

A. rossi was found in an opened coconut shell and *A. leucosphyrus* was obtained once from a hole in a fallen tree in jungle. A most interesting field observation was made at Sungai Lembing bearing on the adherence of species to a particular type of breeding place. A specimen of *A. umbrosus*, a species which usually breeds in the shade of jungle, was caught in Dr. Pou's house which is half a mile away from any jungle. A search was made to ascertain whether the *A. umbrosus* was breeding in the open country or whether it probably had come from the distant jungle. Two breeding places of this species were found in the shade of an old mining tunnel about 100 yards from the house.

BLOOD PARASITES OF LOWER ANIMALS.

A bat obviously ill and unable to fly was caught at the European Hospital and showed on examination a number of endo-corporeal pigmented parasites in its blood somewhat similar to those of quartan malaria. This bat died on the following day. Twenty-four bats were then caught in the hope of getting material for infection and transmission experiments but none of these had parasites in its blood. During this work a rare species of tailed bat, *Mops mops* (Cuv.) and a peculiar apterous earwig, *Arixenia jacobsoni*, were encountered. Specimens of these were sent to the Museum and I am indebted to Mr. H. C. Robinson for identifying them. Neither of these animals had been reported from this country before.

LOCAL OUTBREAKS OF MALARIA.

An outbreak of malaria on the General Hospital hill was investigated and five breeding places of *A. maculatus* were found in the neighbourhood. The breeding place incriminated was on a hill-top a few yards from the infected quarters and consisted of an area of seepage caused by the blocking of a broken house drain by vegetation. The drain was cracked and the water retained by the vegetation leaked through and formed a seepage area in which the breeding occurred. A single case of subtertian malaria was reported among the servants at Carcosa. The surrounding country was examined and some interesting breeding places were found which were reported and immediately destroyed. An examination of the servants at Carcosa and Government House was made and no less than eight out of 36 were found to have crescents in the blood and were therefore possible carriers of infection. This formed an interesting population to watch and two further examinations at intervals of about a month were made, but the population varied so much that at the third examination only 22 out of the original 36 were available and the experiment had to be stopped. Much valuable information is to be obtained from regular periodic examinations of a constant population under uniform conditions and it is hoped to take up observations on these lines in suitable cases.

WORK AT PERHENTIAN TINGGI.

A visit was paid to this place at the request of the Railway Authorities because of the amount of malaria in the station staff. A report was issued on the distribution of anophelines and the most dangerous breeding places were pointed out. The report also contains some observations on three artificial breeding places found there and on certain stagnant pools which were formed by the sealing of the surface of the ground above subsoil drains owing to the deposition of fine clay.

MODE OF ACTION OF OIL.

During the work at Gemas, which has been fully reported*, a remarkable success of oiling was observed in spite of the pools having very incomplete films of oil on their surface. The oil was applied daily to the seepage areas inevitably made during the extensive earthwork which was being done and also by the use of constant drip feeds into contour drains which tapped the seepage areas. This method of application ensured that the oil used was always in fresh contact with the water.

Preliminary experiments have shown that the action of oil by no means depends on having a complete film but that more contact with oil is sufficient to kill larvæ even after they have been washed free from oil and placed in clean water.

This activity of oil is diminished by contact with water and therein probably lies the reason for the success of oiling as carried out at Gemas.

On the urgent instructions of the Principal Medical Officer a letter was forwarded on 30th August giving the results and conclusions of these preliminary experiments. Further work confirms part of the results given in the letter and has led on to a physical explanation of the position taken up by anopheline larvæ on the surface of water, but it has also led to certain modifications of the conclusions given at that time. The problem is much more complicated than is suggested by that letter and work is still proceeding. A thorough understanding of the way in which oil acts may lead to most important results bearing on the kind of oil most suitable and the best methods of using it. The study of this problem will lead on naturally to a standardization of larvacides and the choice of the larvicide most suitable for this country. During this work I have been fortunate in obtaining the help of Lieut.-Col. S. W. Bunker, D.S.O., M.C., of the Agricultural Department, to whom I am much indebted.

* Second Report on the Malaria Problem at Gemas, March, 1919.

JUNGLE AS AN ANTI MALARIAL MEASURE.

In February a report was issued on observations made on a ravine in which the vegetation had been recently felled. An account of the rapid entry of the dangerous species *A. maculatus* into this newly opened ravine is given in this report.

A report on the distribution of anophelines in a ravine covered by secondary growth was forwarded. Only jungle species, *A. aitkeni* and *A. leucosphyrus*, were found under the shade of the vegetation but *A. maculatus* was found in the open space made by a narrow path across the ravine.

In April an investigation was made of an estate which showed a remarkable decrease in malarial admissions to hospital. Dr. Strickland had been consulted owing to the high incidence of malaria and in a report dated August, 1917, advised the abandoning of the ravines and the cultivation of vegetation in them as the main anti-malarial measure. The diminution of hospital admissions for malaria attracted attention and caused much discussion. Many requests were received for an investigation as to whether the improvement of health was directly due to the growth of vegetation.

On investigation it was shown that Dr. Strickland's recommendations had not been carried out in certain ravines and that in other ravines, open places breeding *A. maculatus* were found because the vegetation had not grown properly in the water and silt which marked the site of old drains. *A. maculatus* was shown to be very prevalent and the most common anopheline on the estate. Much malaria was found on examining the labour force and it was shown that malaria could still be contracted on the estate. The growth of vegetation was not therefore sufficient to exclude *A. maculatus* or to render the estate as free from malaria as the hospital statistics would suggest, but on the other hand, Dr. Strickland's advice had not been given a fair trial. The examination of 450 blood specimens from this estate was not completed till the end of the year but a detailed report on the findings will be issued early in 1920, and will contain a consideration of the possible causes of the improvement of hospital admission in spite of the evidence of much malaria in the labour force and abundant anopheline breeding.

FISH.

No further work has been done on this subject. The stock of "Millions" fish is very low and it is probable that in a short time no more will be left. The one place, a swamp at Seremban, in which they had become partially naturalized and had held their own for over four years, was filled and oiled during the year. Before these operations were carried out a new stock was obtained from this place but the fish did not survive long.

The fish imported from India last year, *Barbus vittatus*, did not breed at all and have all died out. In view of the remarks on this subject in last year's report the attempt to naturalize foreign fish, although an interesting experiment, is of quite minor importance.

REPORTS ISSUED DURING THE YEAR.

The following reports were issued during the year. To complete the list of data available for reference this list should be added to the one issued as appendix A to the Annual Report, 1918:

GENERAL REPORTS.—

On mosquito breeding resulting from opening a ravine without preliminary drainage	...	...	...	...	...	...	11-2-19
On the conditions affecting the incidence of malaria on a site at Sungai Besi	...	...	...	...	...	...	14-2-19
On a comparison of anopheline breeding in extremely wet weather with that of the immediately succeeding dry spell	...	...	...	...	...	...	20-2-19
Preliminary note on the second report on the Malaria Problem at Gemas	...	...	...	...	...	...	20-2-19
Second Report on the Malaria Problem at Gemas	...	...	...	...	...	...	8-3-19
On the examination of a ravine covered by secondary growth	...	...	...	...	...	...	10-4-19
On the Malaria Problem at Perhentian Tinggi	...	...	...	...	...	...	31-7-19

REPORT ON ESTATES.—

On a site proposed for a Bungalow on Kepong Estate	17-2-19
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REPORTS ON LOCALLY INFECTED CASES IN KUALA LUMPUR.—

On an outbreak of malaria in Quarters No. 477	23-7-19
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MISCELLANEOUS REPORTS.—

On a complaint of mosquitoes in the Public Works Department Office, Kuala Lumpur	17-2-19
On mosquitoes sent by District Officer, Tampin, caught at Tampin Rest-house	...	...	...	...	...	6-3-19
On mosquitoes sent by District Officer, Tampin, caught at Tampin Rest-house	...	...	...	...	...	7-3-19

MISCELLANEOUS REPORTS—(cont.).—

On a mosquito sent by District Officer, Tampin, caught in his house	... ... ... ... ... ... ...	16- 3-19
On mosquitoes received from District Officer, Tampin, caught in District Forest Officer's house	... ... ...	30- 4-19
On larvæ found at the Ulu Gombak Power Station	... ...	12- 7-19
On mosquitoes received from District Officer, Tampin, caught in Kampong Batu Rest-house	... ... ...	1- 8-19
On a mosquito caught by Mr. C. E. Cummings from the Empire Hotel, Kuala Lumpur	... ... ...	8- 8-19
On mosquitoes sent by District Officer, Tampin, caught at Kampong Batu Rest-house	... ... ... ...	9- 8-19
“ “ “	“ “ “	11- 8-19
“ “ “	“ “ “	13- 8-19
“ “ “	“ “ “	14- 8-19
“ “ “	“ “ “	8- 9-19
On mosquitoes received from Medical Officer, Klang	... ...	2-10-19
On mosquitoes sent by District Officer, Tampin, caught at Kampong Batu Rest-house	... ... ... ...	21-10-19
“ “ “	“ “ “	24-10-19
“ “ “	“ “ “	28-10-19
On a mosquito sent by District Officer, Tampin, caught in his house	... ... ... ... ... ...	29-11-19

H. P. HACKER, M.D., B.Sc. (LOND.).



REPORT ON WORK DONE UNDER THE EXECUTIVE ENGINEER,
MALARIA ADVISORY BOARD, IN THE YEAR 1919.

SELANGOR.
KUALA LUMPUR.

1. (i) Drainage work was further improved and extended during the year. The most important works being—drainage affecting new site for Kuala Lumpur Hospital; neighbourhood of cooly lines, Gaol Road, Loke Yew Road; underdrainage of ravines and swamps in the Hokkien and Cantonese cemeteries; surface drains to carry discharge from quarters and road culverts. A large area of water-logged land north and east of the town has now been well drained and work is still proceeding.

(ii) Expenditure on anti-malarial drainage to end of 1919 has been as follows :

Year.	Construction.	Maintenance.	Approximate area under maintenance at close of each year.
1908-1911	\$47,705	\$ 6,987	
1912	37,527	5,560	1,300 acres
1913	68,459	11,118	3,000 "
1914	22,314	11,157	"
1915	8,989	10,705	3,500 "
1916	23,054	10,487	4,000 "
1917	23,630	10,206	4,500 "
1918	33,222	13,625	5,100 "
1919	43,966	16,998	5,700 "
	<u>\$308,866</u>		

NOTES.—Extensions paid for from maintenance votes have been included under "construction." The figures for 1919 do not include the loss on supplying rice to Tamil coolies.

(iii) The approximate gross drained area is 5,700 acres. The following lengths of drains have been made :

Year.	Masonry drains, lineal feet.	Sub-soil drains, lineal feet.	Open earth channels, lineal feet.
1908-911	17,420	50,400	—
1912	2,550	97,900	—
1913	8,970	109,200	25,300
1914	5,780	70,000	—
1915	5,410	15,600	—
1916-1917	4,400	1,900	39,700
1918	9,300	3,400	4,400
1919	12,100	32,200	2,600
	<u>65,930</u>	<u>380,600</u>	<u>72,000</u>

(iv) Maintenance work was more efficient in 1919 than for some years previously, and arrangements are operating to still further improve it. Later methods of construction have made maintenance of recent work much easier than that of earlier work, but all drainage is liable to damage by natural agencies and requires continual attention.

(v) The table below gives certain vital statistics with reference to death-rates and malaria in Kuala Lumpur :

Year.	Kuala Lumpur Town.			General Hospital, Kuala Lumpur : total malaria cases.		Indians at Police dépôt, Kuala Lumpur.			Police hospital ward : total malaria cases admitted.
	Estimated population.	True total death-rate per 1,000.	True malaria death-rate per 1,000.	Treated.	Admitted.	Average population.	Malaria cases admitted in hospital.	Total.	
1907	40,000	37.9	9.7						
1908	42,800	43.1	10.7						
1909	44,200	32.3	7.7						
1910	45,600	30.3	9.8	...	...	207	881	430	
1911	47,100	39.4	9.9	...	...	230	1,576	685	
1912	48,500	36.7	5.8	...	...	297	974	328	
1913	56,500	35.5	4.2	...	...	322	696	216	
1914	58,100	33.9	3.9	...	...	223	201	90	
1915	59,700	27.1	3.7	...	...	239	141	56	397
1916	61,400	27.7	3.5	...	...	231	257	112	543
1917	63,100	28.5	2.9	1,006	668	235	103	44	233
1918	64,700	38.4	4.0	977	602	186	99	53	244
1919	66,300	26.4	3.8	724	597	157	54	41	154

NOTES.—(a) 1911. Census year.
(b) 1918. Influenza epidemic. Influenza persisted in 1919.
(c) The Indians at Police dépôt are Sikh and Pathan recruits for Police Force.
(d) The Police ward at General Hospital accommodates all sick police in the Kuala Lumpur district.
(e) The General Hospital serves the Government subordinates, clerical and artizan classes of general population. The proportion of population is unknown.

(vi) The work yet to be done in Kuala Lumpur consists mainly of improvement to river margins and drainage and reclamation of swamp lands adjacent. Such work is expensive but the value of useable land is high and the work will be profitable apart from effect on health.

Surveys for some of the larger schemes have been in hand some time but have not been completed owing to staff shortage.

(vii) Malarial infection is now practically non-existent in the drained Government residential area; the completion of drainage and reclamation work still needed will enable it to be stopped in the remainder of town, provided that works are properly maintained and attention is given to casual temporary breeding places. The entire disappearance of mosquitoes from the larger part of Kuala Lumpur is assured if adequate steps be taken to deal with the domestic mosquito.

ULU GOMBAK.

2. Following a visit and discussion with the Senior Health Officer and the Medical Entomologist a report was prepared by the Executive Engineer on anti-malarial measures at the power station site, and provision has been made for certain work in 1920.

PORT SWETTENHAM.

3. (i) Work on the drainage scheme, begun in 1917, was stopped during the first half of year owing to staff shortage. The larger portion of the work has been completed, one new tidal outlet and connected drains being under construction on the north-east side of town.

Seven thousand seven hundred and sixty-six dollars and forty-six cents was expended in 1919, and \$90,831.29 previously; a total of \$98,597.75 against the total estimate of \$105,000. Good progress is now being made and the scheme should be completed early in 1920.

(ii) The tidal outlets constructed are of reinforced concrete, with a special form of sluice. Three of the outlets have been in use for from more than one to two years, and have proved very efficient.

The advantage of the positive exclusion of tidal water has been clearly shown.

(iii) A special form of reinforced concrete drain has been used on the soft mud sub-surface. A considerable length of this was constructed before the end of 1918, and has so far proved satisfactory in use. It has the advantage of being less costly as well as being superior to form of construction previously used.

(iv) Accurate statistics are not available with regard to health at Port Swettenham but malaria is less apparent than formerly. The Medical Officer, Dr. Milne, reports that no cases of malaria have been reported amongst the staff and employees of the Tamil Detention Camp or European officers resident at Port Swettenham, since he took charge (March, 1919).

(v) All drainage schemes require improvement from time to time to meet expansion of town areas, and the development of Port Swettenham will shortly require additions to the masonry drain system. The tidal outlets have been designed to cope with all likely development.

NEGRI SEMBILAN.

SEREMBAN.

4. (i) Work on drainage scheme was seriously delayed during first few months of year owing to sickness of Assistant Engineer in charge, but fair progress was made towards the end of the year, especially with ravine drainage.

The expenditure in 1919 was \$41,048.96; previously \$58,395.21; total \$99,444.17.

The work done includes 7,120 lineal feet masonry drains } completed
92,100 lineal feet subsoil drain } completed
11,500 lineal feet work on channel of Sungai Temiang not yet completed.

(ii) Owing to rise in prices since estimate was prepared the estimated cost will be exceeded, and a revised estimate of cost of completion was prepared and forwarded to the British Resident.

5. Some materials for underdrainage not elsewhere obtainable have been supplied from Kuala Lumpur to the Public Works Department at Tampin.

6. Gemas was visited in connection with the mosquito surveys made by the Medical Entomologist and oiling work by the Railway Department.

PERAK.

7. The Executive Engineer visited Kampar in connection with drainage work to be constructed by the Public Works Department, and Tapah and Sungkai with reference to surveys for drainage work to be made by same department.

The District Officer at Kuala Kangsar endeavoured to secure a surveyor for work in that town but was unsuccessful.

PAHANG.

8. No work was done in Pahang during the year.

STRAITS SETTLEMENTS.

9. The scheme of drainage for the town of Lumut prepared by the Executive Engineer in 1919 was begun by the Colonial Public Works Department early in 1920.

Certain materials not elsewhere obtainable are being supplied from Kuala Lumpur at the expense of the Colonial Government.

PRIVATE AUTHORITIES.

10. Owing to lack of staff little assistance has been afforded to private authorities for some years past.

Reports were made to a few estate managements during 1919 on drainage proposals but as there are no persons available in the country qualified to carry out such proposals nothing resulted. An urgent need exists for trained officers capable of advising estate managements in the carrying out of drainage measures, and were they available I am confident that many estates would be ready to proceed with such measures.

GENERAL.

11. (i) Co-operation has been maintained with the Senior Health Officer and the Medical Entomologist. The Medical Entomologist made special surveys of anopheline breeding of one or two areas in Kuala Lumpur, and his reports are being utilized in the drainage work programme. He was unfortunately not able to continue routine surveys in Kuala Lumpur.

(ii) The drainage work in Kuala Lumpur was inspected by various authorities and others interested both from this and other countries.

(iii) The efficient tidal drainage at Port Swettenham has been referred to. Dr. M. Watson has brought this work to the notice of estate managements on the Selangor coast.

Efficient tidal drainage would be of great benefit in this area and others similar.

(iv) There is an urgent need for demonstration work of an experimental character to further improve drainage methods in detail. Much progress has been made in this direction already but a great deal more is wanted.

STAFF.

12. (i) Staff shortage continued to hamper work in every direction. During the early part of the year the Executive Engineer was single handed.

The failure to obtain a number of senior assistants has been disappointing and discouraging.

The shortage in subordinate staff is even more serious. Efforts have been made to recruit subordinates both locally and in India, but only one man was obtained. There is little doubt competent technical subordinates now command much higher salaries than those hitherto offered in the local service.

Attempts have and are being made to train junior subordinates.

(ii) Mr. F. D. Evans continued as Executive Engineer throughout the year.

Mr. P. A. Molloy, Assistant Engineer, following much sickness early in year, went on leave on 12th August, 1919.

Mr. T. M. Gordon, Assistant Engineer, who had been with the Imperial Forces since 1914, did not return to this country and left the service.

Lieut. F. M. Corkill, was appointed as Assistant Engineer and took up duty on 28th March, 1919.

Mr. J. E. Bach was engaged locally as temporary Assistant Engineer and took up duty on 18th July, 1919.

The subordinate staff at close of year consisted of one Grade II overseer, and one assistant draftsman, three temporary technical subordinates.

The clerical staff consisted of one Class II, one Class III and two temporary clerks.

EXPENDITURE.

KUALA LUMPUR TOWN.

Federal Estimates, 1919, page 62, item 15—

Maintenance of anti-malarial drainage { Provision \$ 4,000.00
Expended 3,999.14

Selangor Estimates, 1919, page 40, item 3—

Maintenance of anti-malarial works { Provision 13,000.00
Expended 12,998.87

Details of maintenance charges, Kuala Lumpur town—

Federal and State.	Maintenance.	Capital charges.
1. Supervision	\$2,723.70	
2. Cutting grass and surface clearing	3,973.33	
3. Surface repairs	1,169.65	
4. Clearing and relaying pipe drains, 5,254 lin. feet	797.38	
5. Masonry drains, clearing and repairs ...	3,008.87	
6. Open earth drains and streams ...	1,103.91	
7. Materials and transport ...	846.41	... \$145.71
8. Store, lines, assessment, miscellaneous ...	2,505.60	... 656.50
9. Laying new pipe drains, 930 lin. feet	—	... 66.95
Total ...	\$16,128.85	... \$869.16
		\$16,998.01

Selangor Estimates, 1919, page 40, item 12—

Special maintenance of anti-malarial works, Public { Provided \$1,500.00
Gardens, Kuala Lumpur { Expended 1,500.00

Special expenditure on account of retention of trees in ravine and clearing silt from Sydney Lake head. Not included in summary of maintenance charges:

Selangor Estimates, 1919, page 41, item 13— { Provided \$46,000.00
Anti-malarial measures, Kuala Lumpur town ... { Available 43,097.44
Expended 43,097.33

WORK DONE OR IN HAND.

1. Drainage of land between Leper Asylum and Sungai Bunus and Sungai Gombak.
2. " " into Treacher Valley Stream.
3. " " between Loke Yew Road, Gaol Road and Railway line.
4. Underdrainage of ravines, Cantonese Cemetery.
5. Drainage of ravines, Hokkien Cemetery.
6. Connection of road culverts and drains from quarters to existing masonry drains.

Selangor Estimates, 1919, page 44, item 113— { Provided \$15,000.00
Drainage, Port Swettenham { Available 14,168.71
Expended 7,766.46

Negri Sembilan Estimates, 1919, page 41, item 3—

Anti-malarial Works, Seremban { Provided 41,104.79
Expended 41,048.96

Negri Sembilan Estimates, 1919, page 40, item 5—

Maintenance of anti-malarial works { Provided 4,200.00
Supplementary 4,400.00
\$8,600.00

Expended maintenance \$2,779.67

Oiling of undrained swamps under Health Officer 4,828.87

\$7,608.54

DETAILS OF MAINTENANCE EXPENDITURE.

1. Supervision ... ... ... ...	... ... ... ...	\$ 557.55
2. Cutting grass and surface clearing ... ...	... ... ...	1,298.30
3. Surface repairs ... ... ...	... ... ...	450.04
4. Clearing and relaying pipe drains ...	... ... ...	17.47
5. Masonry drains clearing ... ...	... ... ...	31.35
6. Miscellaneous ... ... ...	... ... ...	424.96
		\$2,779.67

REPORT OF THE INSTITUTE FOR MEDICAL RESEARCH, 1919.

I.—BERI-BERI.

The preparation of Fraser and Stanton's extract of rice-polishings by the improved method, which Dr. Stanton and Mr. Marsden devised in 1918, was continued during the present year and over four thousand doses were issued to Government hospitals.

By the careful observation of a series of selected cases at the District Hospital in Kuala Lumpur, Mr. Lesslar, the Assistant Pathologist, obtained further evidence of the value of the extract in the treatment of beri-beri.

Thirty-one patients who had suffered from the disease for less than three months improved rapidly under a course of treatment; but, on the other hand, five men who had been ill for a longer period, did not appear to derive any benefit from the extract.

These results confirm the conclusion reached in the previous year, that the extract is potent in the early stages of the disease only, and that the earlier the patient is treated the more rapid will be his recovery.

II.—PSEUDO-CHOLERA.

Some five and a half years ago a very fatal epizootic occurred among the laboratory rabbits and guinea-pigs. The disease began with catarrh of the nose and eyes and a discharge which soon became purulent and white, like milk. The affected animals died in a few days and, after death, miliary tubercles and caseous nodules were found in almost all the organs of the body. The respiratory tract was always involved and the earliest lesions occurred within the nose.

The disease, in many respects, resembled pseudo-tuberculosis but was quite distinct from it. It was caused by a small motile bacillus, very like the organism of plague in appearance (*B. pestis*) but entirely different in culture.

All the evidence pointed to the infection of the animals by their food, which consisted of sweet potato leaves procured from a Chinese vegetable-gardener, and this theory was eventually proved to be correct by the isolation of the bacillus from the leaves.

The appearance of this bacillus, its growth on laboratory media, its biochemical properties and its effect on animals were identical with those of the organism isolated by Dr. Stanton from human cases of the disease to which he referred in last year's report as "Pseudo-cholera."

The only culture available from the 1914 epizootic was one which had been killed with formalin vapour and sealed up in a test-tube for the purpose of reference.

With the object of investigating the relation of this epizootic bacillus to that of "pseudo-cholera", a rabbit was immunized by the injection of several doses of an emulsion of this culture with the result that the animal's serum acquired the property of agglutinating Dr. Stanton's pseudo-cholera bacillus in high dilutions; moreover, the specific agglutinins for the homologous organism were removed from the serum by saturation with the pseudo-cholera bacillus. Similarly the serum of a rabbit immunized against pseudo-cholera agglutinated the epizootic bacillus.

As a further test the rabbit, which had been immunized against the epizootic disease, was inoculated with a large quantity of a living culture of pseudo-cholera organisms (four times the quantity sufficient to kill a rabbit in three or four days), and this dose it survived; thus showing that the inoculation of the dead epizootic germs had protected it against inoculation with the living organisms of pseudo-cholera.

These results demonstrate the identity of the organism which caused the laboratory epizootic in 1914 and that which causes "pseudo-cholera" in man.

III.—CHOLERA.

Sixty-eight specimens were received from Medical Officers to be examined for the presence of cholera vibrios and these were found in eleven cases.

Owing to the occurrence of cholera in Lower Perak, Mr. Lesslar was detailed for special service there, in January, for the purpose of determining if any of the healthy coolies, on an estate where several cases had occurred, were harbouring the germs of the disease and were acting as "carriers" of infection. Eight hundred and sixty-six coolies were examined with negative results.

IV.—CEREBRO-SPINAL FEVER.

Twenty-two specimens of cerebro-spinal fluid were examined and in six of these the meningococcus of cerebro-spinal fever was found to be present. Several specimens, which had been sent from a distance, were contaminated with other organisms so that a satisfactory examination was impossible.

Sporadic cases of this disease have occurred in the Malay States for several years, but it has undoubtedly become more common. Primarily it is an infection of the nasal passage and the increase in the number of cases may be associated with the prevalence of respiratory diseases such as influenza.

V.—DIPHTHERIA.

Thirty-seven cultures were examined for diphtheria bacilli, with positive results in ten cases. Diphtheria is another disease which, formerly, was almost unknown in the country and which is now becoming regrettably common. As an illustration of its former rarity it may be mentioned that during the years 1904-1908 not a single case of diphtheria, or of disease resembling diphtheria, was admitted to the General Hospital at Kuala Lumpur.

It is not, however, a disease entirely new to the country, sporadic cases occurred, at long intervals, as far back as 1906.

The increase in the number of children attending schools and the prevalence of respiratory diseases, such as influenza, are probably responsible for its greater frequency.

VI.—VENEREAL DISEASES.

A large amount of material was received for examination in connection with the diagnosis of venereal disease. Four hundred and fifty-three samples of blood were examined by Wassermann's test, with positive results in 170 cases.

Mr. Lesslar carried out a series of comparative tests by Hecht's simplified method, but found it unreliable. He also investigated Wassermann's reaction in 75 cases of beri-beri and his results tend to show that beri-beri does not cause the reaction to become positive.

VII.—OTHER INFECTIOUS DISEASES AND MISCELLANEOUS.

Two hundred specimens of blood were examined by agglutination tests. Forty-nine agglutinated typhoid bacilli, two agglutinated *B. paratyphosus A.* and 12 agglutinated *B. paratyphosus B.* The majority of the samples, which gave positive results, were received from the State of Perak.

One hundred and seventy-six specimens of faeces were examined bacteriologically, *B. dysenteriae* (Flexner) was isolated 21 times, *B. dysenteriae* (Shiga) once and *B. paratyphosus B.* once.

The brains of 18 dogs were examined for rabies with positive results in 10 cases.

A number of autogenous vaccines were prepared for the treatment of different diseases.

Fifty new growths were examined.

A considerable number of mosquitoes and larvae was received for identification.

VIII.—CHEMICAL EXAMINATIONS.

The work in chemistry has been largely of a routine character. The total number of examinations was 2,579.

Stained articles for presence of blood numbered 38 and in 11 of these human blood was identified. Exhibits for the identification of poisons numbered 58.

Opium was found in two cases, and arsenic in two cases. In seven cases of alleged cattle poisoning arsenic was found in three.

IX.—CHANDU AND CHANDU DROSS.

Forty-five exhibits were received. Of these, six were illicit opium and nine were viscous substances resembling chandu in appearance but containing no opium.

Three exhibits of chandu dross were found to contain "ainang."

X.—WATER SUPPLIES.

Eighty-nine samples of water from existing or proposed domestic supplies were examined.

The public supplies of Kuala Lumpur were examined at regular intervals.

The public water supply of Taiping was examined only three times.

XI.—MILK SUPPLIES.

Two hundred and sixty-three samples of fresh milk were examined.

Thirty-one per cent. were deficient in milk solids compared with 27 per cent. in 1918, and 25 per cent. in 1917.

No sample of condensed milk was received.

XII.—ALCOHOLIC LIQUORS.

Twenty-eight samples of spirits were analysed for Licensing Boards.

Thirteen samples of spirits purchased under the Sale of Food and Drugs Enactment were examined.

Two hundred and eighty-one liquors were examined for alcoholic strength most of these were received from the Supervisors of Customs.

Three hundred and sixty-five samples of toddy were examined, from Selangor 268, from Perak 73, and from Negri Sembilan 17.

In 18 samples the acidity was greater than 0.8 per cent.

XIII.—COINS AND COINING MATERIALS.

In two cases of counterfeit coining 1,374 exhibits were examined.

Of these exhibits, 1,367 were counterfeit coins.

XIV.—STAFF.

Dr. W. Fletcher returned from leave on 17th September, Dr. A. T. Stanton proceeded on leave on 23rd September, Mr. R. W. Blair returned from leave on 11th November.

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